

TUMOR OF THE SUPERIOR PARIETAL CONVOLUTION,
ACCURATELY LOCALIZED AND REMOVED BY
OPERATION.*

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It will probably be admitted that the following case is one of unusual interest from the clinical, physiological and surgical points of view. The diagnosis of the case naturally gave rise to differences of opinion, chiefly because of the absence of some of the most frequently observed manifestations of organic focal disease and the presence of other symptoms and signs commonly regarded as characteristic of functional nervous disorder. The difficulties of diagnosis between grave hysteria and serious organic focal disease of the brain were in the foreground at several stages in the history of the case. Physiologically the case is important because it has added something to our knowledge of the areas of representation of muscular and cutaneous sensibility and of trophic functions. Dr. W. W. Keen will consider the surgical aspects of the case, and I shall only say here that the operation in method and execution was one of the most brilliant of the many that it has been my good fortune to see. The following is the history of the case in detail:

Mr. S. R., fifty-seven years old, enjoyed good health until 1884, when he became very nervous, emotional and despondent, and began to suffer from headaches chiefly in the back of the head. One physician whom he consulted at this period

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told him that he had beginning softening of the brain, a diagnosis which exercised a depressing influence upon him. He went to Europe, spending a few weeks at Kissingen and about twenty-two months at Frankfort-on-the-Main, where he lived an easy and quiet life and recovered almost entirely, except that he had an occasional headache. He returned to America and to his business in 1886, and for eight years from that time he remained in comparatively good health.

In 1894, while walking on the street, he suddenly felt an unpleasant sensation in his right arm, which he described as a feeling as if a mouse or ants were creeping down his arm. After this, sometimes at intervals of days, and at others of weeks, or even months, he had similar paresthetic attacks in the right arm; these were sometimes described as a tingling or battery sensation. They came on suddenly and passed away in a few moments. After the attacks the arm would feel somewhat heavy. During the attacks he was never unconscious and so far as could be learned he never suffered from vertigo. From this time on he was more or less neurasthenic and hysterical, with periods of great despondency. He suffered much with a feeling of pressure or distress in the head, which he usually referred to the left parieto-frontal region. At times it took on the character of a true localized headache, but this was exceptional, the uncomfortable sensation usually being described by the patient as a feeling of pressure or distress. He was fully able to attend to his business until January, 1899, although he was often nervous and did not feel well. In 1894 he consulted Professor Eichhorst; he was also seen by others, but so far as I could learn the diagnosis of organic brain disease was not made, except the opinion expressed in 1884 that he had softening of the brain, which in the light of his subsequent history was evidently without good foundation.

In June, 1899, he first noticed that he was beginning to use his right upper extremity awkwardly, and a week or two later a similar awkwardness of movement became noticeable in his right leg. From this time he had slowly increasing difficulty in the use of his right arm and right leg, and especially the former. The disability became markedly worse about the middle of August, and was described by the patient as a loss of power, although my first examination of him, made August 21, showed that the disorder in the limbs of the right side was ataxic rather than paretic. He had no pain in the affected extremities; but he complained frequently of a feeling of pressure in the left parieto-frontal region. He also had frequent attacks of a hysterical character with great despondency.

My first examination of the patient on August 21, 1899,

showed that he had distinct but not very marked ataxia both in the right upper and lower extremities, the ataxia being more marked in the arm. Sensation to pain, touch and temperature was impaired over the right half of the body, and he had distinct astereognosis in the right hand. Muscular power was good in the right arm and leg, although the patient complained of a feeling of heaviness in these parts.

Between August 21 and September 25 I saw the patient three or four times. The ataxia of the extremities got gradually worse, and he daily complained of a sensation of pressure or pain, which he always referred to the left parieto-frontal region. On questioning him closely about the sensation he would usually state that it was not exactly pain but rather a feeling of pressure or distress, although at times he referred to it as a pain or even as a headache. From September 25 I saw the patient almost daily, and not infrequently twice or oftener in a day. About this time I first expressed the opinion that he was probably suffering from a slowly developing brain tumor.

Frequent examinations were made after he came under constant observation, the results being similar to those obtained September 29, when he was seen in consultation with me by Dr. F. X. Dercum and Dr. Wm. G. Spiller. The following points were recorded at this time:

Hypesthesia to touch, pain and temperature was present on the right side of the body; face, trunk, arm and leg all being examined. Sensation was nowhere completely lost, although distinctly impaired as determined by numerous tests. Sensation was a little less impaired in the right side of the nose and in the right cheek near the nose than in other regions in this half of the body. The mucous membranes on the right, as well as the skin, showed partial anesthesia. The right conjunctival reflex was diminished. Examination for hearing, smell and taste showed also some slight diminution, a result which was subsequently not uniformly obtained. Frequent tests were made with his right hand as to the condition of the stereognostic sense. He was found to have distinct astereognosis in the right hand. Ataxia of both the upper and lower extremity on the right side was very marked, and he was also somewhat paretic in both, but more so in the leg than in the arm. The knee-jerk, quadriceps-jerk, and other tendon and muscle phenomena on the right side were slightly exaggerated, and he had distinct but soon disappearing ankle-clonus on the right side; toe-jerk and front-tap were absent. The Babinski reflex at this time was also absent, irritation of the ball of the foot causing plantar flexion. The patient at the time of the exami-

nation and almost continuously at and after this period showed many hysterical symptoms.

Almost daily examinations were made subsequent to this time. The patient's condition grew slowly worse. The notes made from October 5 to 9 showed about the following conditions: He continued to have diminished sensibility to pain, touch and temperature in the right half of the body, not notably worse than when previously examined. The tests for hearing, smell and taste showed nothing of a decisive character, although taste at times seemed blunted on the right side and at others on both. The right half of his tongue was continuously more coated than the left. The ataxia of arm and leg became more and more marked, and the loss of power in these limbs was slowly deepening into a profound paralysis. Astereognosis was now of the most decided character. While the knee-jerks were not markedly different on the two sides, persistent ankle-clonus was now always obtainable on the right. The Babinski reflex could sometimes be obtained on the right and sometimes not, but even when the plantar response was normal the flexion of the toes was not as active on the right as on the left. The toes of the right foot were now continuously in a state of partial metatarso-phalangeal dorsal flexion.

It was noted about October 9 that for a time that could not be accurately fixed the patient had shown some amnesia for names and words. He frequently could not recall the names of his recent or earlier physicians, and occasionally he was unable to recall the names of familiar objects. Because of this difficulty he was at times unable to continue a consecutive conversation. His amnesia varied greatly, however, at different times, and seemed to be considerably affected by his emotional state.

On October 9 he was tested as to his ability to read, using a few lines from a newspaper and a poem containing chiefly words of one or two syllables. He read slowly and with effort, but did not mispronounce the words. He was quickly fatigued by the reading. Now and then he complained of some disturbance of vision, but this was not persistent and may have been due to some defect of refraction.

He continued to complain of a feeling of pressure or pain, or of something wrong in his head, usually putting his hand at these times to the left side of his head near the vertex; occasionally he complained of occipital pain, but his statements regarding pain in the head were vacillating.

On several occasions in October he was examined by Dr. S. D. Risley, who reported some disorder of refraction, but that optic neuritis was not present. The tests for his color fields

were somewhat confusing, at times showing reversals and at others not. The fields for form and color were however contracted. At one examination he had, or appeared to have, a partial right lateral homonymous hemianopsia, but when examined again this could not be determined. Wernicke's symptom was not present.

Some paresis of the right side of the face and a slight deflection of the tongue to the right were now observable. The soft palate was also deflected a little to the right. During October and November the patient's pulse always ranged below normal; on several occasions it fell as low as forty to the minute, and most frequently varied between 45 and 60. Inquiry elicited the fact that the patient's pulse was slow when he was in good health, probably ranging in the neighborhood of 60. As a rule the patient presented no pupillary or other ocular symptoms, but on October 17 an inequality of the pupils was observed, the right being larger than the left. This inequality remained only a day or two. Although the patient's symptoms were chiefly right-sided, some interesting observations were made from time to time with regard to the conditions present in the left half of the body. The left leg remained practically normal; the movements of the left arm however showed some incoordination, as determined by the usual methods of having the patient with his eyes closed touch various parts of the face and pick up objects of different size. The ataxia was comparatively slight and seemed to be aggravated by the patient's emotional and hysterical condition. No objective cutaneous or muscular anesthesia and no astereognosis were ever detected in the left half of the body, but late in October the patient complained of a feeling of numbness in the left hand, a symptom which remained until after the operation. He continued to be seen at intervals by Drs. Dercum and Spiller in consultation. For several weeks late in October, apparently as the result of the use of mercurial inunctions and the iodides, he made some improvement in the use of his arm and leg, but about November 1 he had lost all he had gained and in a few days was distinctly worse. The paralysis especially became more and more profound and his use of language more restricted. Some wasting was noticeable, especially in the right upper extremity. On November 18 he had what appeared to be a slight apoplectic-form attack in which he became much confused and agitated, and lost his speech entirely for about an hour, but he was not unconscious.

He was seen in consultation November 19 by Dr. James Hendrie Lloyd and Dr. William Osler. Paralysis of the right arm and leg was now almost absolute. The face showed only

slight paresis. The ataxia of the limbs of the right side was now masked by the completeness of the paralysis. Hypesthesia as to touch, pain and temperature was about the same as on numerous previous examinations. Right ankle-clonus and the Babinski reflex were present, otherwise the deep reflexes were not much altered. The muscles of the hand, forearm, arm, shoulder, breast and leg of the right side showed distinct atrophy. He had extreme difficulty in recalling words; he could not keep up a consecutive conversation and only with difficulty answered questions regarding himself. He complained, as often before, of pain on the top and left side of the head. The sphincters of the bladder and bowels showed some tendency to relaxation, and he was in a distressing emotional state.

November 20 the patient was taken to the private hospital of Dr. W. W. Keen, operation for the removal of a brain tumor having been decided upon. The operation was fixed for November 24, and the day previous a final consultation regarding the case was held, those present and taking part being Drs. W. W. Keen, F. X. Dercum, J. H. Lloyd, W. G. Spiller, S. D. Risley, J. W. McConnell and the writer. A re-examination of the patient was made at this time, but this developed no new symptoms or conditions. The paralysis, anesthetics, speech defect, reflexes, and emotional state remained as given in the immediately preceding notes. Dr. S. D. Risley made a final critical examination with the ophthalmoscope and reported the absence of all evidences of optic neuritis.

Two months previous to the date fixed for the operation I had diagnosticated brain tumor, and then and subsequently had fixed upon the left superior parietal lobule as its probable site, although I regarded the growth as most likely originating in the subcortex. With the accord of my consulting colleagues it was decided to operate with the view of first uncovering this portion of the brain. The localization was in the first instance based upon loss of the muscular sense, impaired cutaneous sensibility, astereognosis and ataxia. It may be well here to briefly summarize the data which led both to the general diagnosis and to the localization of the growth; later the most important points in the case will be discussed in more detail.

About five months previous to the operation the patient began to show some ataxia in the right arm and later in the

right leg, and when investigation of his condition was first made by the writer all forms of cutaneous sensibility were impaired, muscular sense was lost, and astereognosis was a marked symptom. As the case progressed paresis and eventually paralysis of the arm and leg supervened, this when complete of course masking the ataxia. The patient developed a disorder of speech chiefly showing itself as a verbal amnesia and fatigue on reading. At one examination the patient showed a temporary partial right hemianopsia. Reversals of the color fields and contractions of the fields for form similar to those supposed to be typical of hysteria were present at several of the examinations. The reflexes on the ataxic and paralyzed side were somewhat exaggerated, ankle-clonus being present. The patient was emotional and markedly hysterical. The general symptoms of brain tumor were not only not prominent but the most important of them were absent. The patient had not the typical severe headache so often present in cerebral neoplasms, although he complained much of feelings of discomfort, distress and pressure, and occasionally of pain, these sensations being almost uniformly referred to the left parietal or parieto-frontal region near or about the median line of the head. Vertigo, nausea and vomiting were not symptoms, and optic neuritis was entirely absent as shown by repeated careful examinations. The patient from first to last had no convulsions, and not even the slightest local spasm. In spite of the difficulties in the way of correct diagnosis it was believed that the case was one of brain tumor originating in what the writer holds to be the true cerebral sensory area, this opinion being based chiefly on the sensorial localizing symptoms and on the pressure symptoms which ensued as the growth enlarged in size and the case developed. The visual symptoms, the disorder of language, the motor paralysis, and the changed reflexes were thought to be in the main pressure symptoms, although it was believed that the motor subcortex had probably been invaded to some extent.

An operation which was successfully performed by Dr. W. W. Keen November 24 exposed a tumor in the exact region which had been assigned as the seat of the growth. The details of the operation, which was in many respects of unusual

interest, and the subsequent surgical progress of the case, will be described by Dr. Keen.

The patient was fully conscious about three hours after the completion of the operation, although weak and nauseated. Dr. Keim, who was constantly with the patient as nurse and attendant for several weeks before and after the operation, recorded that, after coming out of the ether, the patient could talk freely. Within forty-eight hours he could not speak more than a very bad (indistinct) "yes" and "no"; in seventy-two hours he could say "yes" and "no" plainly; at ninety-six hours he could make sentences of three or four words, as "I want my wife." Five days later he could make sentences of six to ten words.

On the day after the operation he was examined by me, but only briefly, I believing it best to avoid any prolonged investigation of his condition. He was weak and complained of pain in the head in the region of the operation, and also of some pain shooting down the right side of the neck and down the arm of the paralyzed side. Both arm and leg were completely paralyzed, but there was no paralysis of the face. Sensation to touch and pain were diminished on the right side more markedly than before the operation. He remained much the same for several days, his general condition, however, slowly improving. On November 28 temperature and pulse were about normal, his respiration good, and the case in general was progressing favorably. On the 29th he talked more freely than at any time since the operation.

On December 2, eight days after the operation, slight motion was noticed for the first time in the right leg. Each day this ability to move the leg slightly increased, and by December 4 he was able to partially flex the thigh on the pelvis and the leg on the thigh. During the week from December 4 to December 11 he daily gained additional power in his right leg. As just stated, he was first able to flex the thigh on the pelvis and the leg on the thigh; next to thrust or push downward the leg, and later to carry the right leg toward and finally over the left. About the 7th day after the first return of power he was able to slightly flex the toes; at first he could dorsally flex the great toe; dorsal and plantar flexion of the toes came a few days later. Sensibility to touch, pain and temperature continued to be greatly impaired on the affected side, but it was nowhere absolutely abolished. Moderate right ankle-clonus was present; the knee-jerk was slightly exaggerated and the plantar reflex seemed to halt midway between normal plantar flexion and the Babinski reaction. His speech was improving, but vacillated considerably, and was without doubt greatly in-

fluenced by his emotional state. December 6 a slight return of power was first observed in the upper extremity. The first return observed was a slight pushing or extension movement of the entire arm backward and forward. He had frequent attacks of depression and emotional excitement due to apprehension.

On December 11 I made a careful examination of the patient in conjunction with Dr. Wm. G. Spiller. The patient sat up in an arm chair during the examination. He talked with considerable freedom, although occasionally at a loss for a word, and especially for a proper name or substantive. He was able to flex the thigh on the pelvis and the leg on the thigh, and with a little effort to carry the paralyzed limb over the thigh of the opposite side. He had a slight movement of extension and flexion of the toes, could dorsally flex the foot in a feeble manner, but could neither abduct nor adduct it, nor could he lift the heel with the calf muscles. All the movements which had returned were comparatively feeble, but the proximal were relatively much stronger than the distal movements of the limb. He was able to extend the forearm somewhat strongly, could feebly flex the forearm at the elbow and also draw the arm backwards. He could pronate the hand when it had been placed in a supine position. He had not at this time recovered any of the movements of the hand and fingers except that of pronation of the hand. The movements regained were all feeble, extension of the forearm which was the first to return being the strongest. Carefully testing for cutaneous sensation it was found that tactile sense was much impaired and that the senses of pain and temperature were also diminished, although these were relatively better preserved than the sense of touch. If anything, cutaneous sensibility was a little more defective at this time than prior to the operation. His hand was still too much paralyzed to test him for the stereognostic sense, but he was tested for muscular sensation and sense of position by blindfolding him and having him put his unparalyzed hand on the right. This he failed to do on his first attempt, but succeeded on later efforts, although he did not accomplish the act readily; he sometimes carried his left hand to the right forearm and then slipped it down to the hand. Evidently the muscle sense was still much impaired. Wasting was still very manifest in the right upper extremity, and especially in the right hand. The right knee-jerk was marked, moderate ankle-clonus was present. The Babinski reflex was absent, although the normal plantar response was not prompt. He had no headache, but complained of some dizziness.

It would be tedious and in the main unprofitable to con-

tinued to trace in great detail the progress of this case. Slow but sure improvement went on from day to day. The leg and arm continued to gain in power and control; sensation in all its forms gradually returned; speech improved until it was normal; and after a proper correction of his refraction had been made by Dr. Risley the patient was able to read about as usual. He continued to have recurring attacks of depression and emotionality, the tendency of these attacks being apparently in part temperamental and in part the result of his long period of apprehension and real suffering. Notes of his condition were made at frequent intervals, but I shall only recall a few of these made at intervals between December 11 and March 3, 1900, on which day he started with his son for a trip of six weeks or more, during which he expected to visit Gibraltar, Genoa, Naples and Alexandria.

On December 18 it was found that he had recovered several additional movements of his leg. He could dorsally flex the foot with facility and also lift the heel from the floor. All the movements formerly regained were greatly improved. He made a good effort to stand and walk with assistance. The arm also showed a decided improvement. He was able to lift the semiflexed arm to the shoulder line. He could also slightly flex the fingers and pronate and supinate the hand. He talked with comparative fluency, only very occasionally being at loss for a word. He read aloud a newspaper extract for me, making only a single mistake. His general health and strength and his mental state were greatly improved.

On December 27 touch, pain and temperature sensations were almost normal; he merely recognized a very slight difference in the degree in which he felt objects in favor of the left side. His hand and arm had gradually regained almost all their movements, although many of these were still feeble, especially those of the hand and fingers. Although scarcely able to grasp objects as small as a knife or key, he was able to recognize them by their shape, but not as promptly or as accurately as with the other hand. His stereognostic sense had returned largely but not fully. He was now able to walk a few steps alone. On December 31 it was noted that the patient could now walk across the room without aid. Movements of the fingers, hand, forearm and arm were still improving. Within a few days some tremor became noticeable in the hand or fingers when he made forcible movements or tried to make such movements of the hand and arm. This tremor frequently recurred, but as his limb grew stronger became less marked. On February 7 the following note was made: I saw the patient last evening and I have seen him at short intervals, but

at least once a week, for several months past. He has been at Atlantic City for four to five weeks, and has continued to improve steadily. He can now walk several blocks and his arm and hand have improved to such an extent that he can make some use of them in feeding himself, putting on his clothing, etc. Yesterday he wrote a short but entirely legible note with pen and ink. Cutaneous sensibility is practically normal. He has gained flesh and his general appearance is excellent. He complains at times, particularly after he has used the limb considerably, of a feeling of heaviness in the right leg, in which muscular sensibility is still somewhat impaired. He also makes somewhat frequent complaints of pain in the head, which he refers to the anterior portion of the cicatrix or wound left by the operation.

Three days before he left for his sea trip I again made a careful examination, and could not discover that he had gone back in a single particular, in spite of the fact that he was at times apprehensive and complained considerably of pain in the head which seemed to me to be due to nervousness and possibly to some sensitiveness of the scalp and membranes left by the operation. The pain at times disappeared entirely and was influenced by the weather and emotional states. His lower extremity retained all the movements that it had gained, so that he was able to stand and walk with facility, both on the level and even up and down stairs, although he complained that the limb became heavy after moderate exercise. Both ataxia and paralysis had largely disappeared from his upper extremity. Cutaneous sensibility was practically normal.

It is difficult accurately to fix the date of the pathological beginning of this case. It appears from the history that the patient was first supposed to be suffering from some affection of the brain in 1884, that in fact he went to Europe on the advice of his physician because of headache and other somewhat indefinite but probably neurasthenic symptoms. After a stay abroad of about two years, however, he seems to have regained his usual health, and it was not until 1894 that he was again seriously troubled. During this year he began to have peculiar paresthetic attacks, which in the light of subsequent developments were evidently a form of limited cerebral sensory discharge. The real time of the beginning of the cerebral lesion was probably a few months, or at the most a year or two prior to the first of these attacks, although it is of course possible that some organic disease may have been present as

early as 1884. It is more reasonable to presume that these earlier symptoms were of a hystero-neurasthenic, or at least of a functional character. With the exception of the occasional subjective sensory attacks in the right arm he had no active localizing symptoms for five years, although he was more or less neurasthenic, hysterical and despondent. The history of the case and the lesion and conditions found at the operation show conclusively that the tumor was subcortical in origin, and it was not until it had been growing for five years and had reached the cortex in the parietal region that persistent active symptoms were manifested. In discussing this case it is of great importance to note the manner in which the objective localizing symptoms developed. These were at first confined to impairment of muscular and cutaneous sensibility with associated astereognosis and ataxia. All other localizing signs, trophic, motor, visual, aphasic and reflex, were practically absent—a fact which, taken in connection with the early focal diagnosis which was made, supports the contention of those who believe that for practical purposes the cerebral areas for sensation and motion can be separated. The later symptoms, in so far as they were organic, were partly those of destruction and partly those of pressure. Unless the early symptoms were kept constantly in mind and a close analysis of the progress of the case from stage to stage was always before one studying its phenomena, the added symptoms serve to cloud rather than to clear the diagnosis.

The two things chiefly relied upon in making a diagnosis were the order of development of the clinical phenomena and a limited number of positive localizing symptoms. It will not be necessary to recall here the facts showing the method in which the case developed step by step after the first appearance of active symptoms in 1899. The appearance and progressive increase of the ataxia and astereognosis, the slow augmentation of clinical phenomena which pointed to pressure or implication of the cerebral motor regions, the increase in amnesia and paraphasia, the presence with variations in degree of ankle-clonus and altered plantar reflex on the same side, and the appearance of decided atrophy, constituted together an orderly train of phenomena which could hardly be explained except on

the ground of an organic focal lesion, and as an enlarging neoplasm could best explain the sequence of events the diagnosis of a cerebral tumor seemed to me inevitable. The positive symptoms were those already so fully detailed as pointing to the parietal lobe.

The most important of the general symptoms of brain tumor were either absent or so subordinated to other features of the case as to not give to them the high rank which they usually attain in the diagnosis of brain tumor. While the patient frequently complained of feelings of pressure or discomfort, and sometimes of localized headache, the pain in the head was not of the agonizing and persistent character, and had not the paroxysms of extreme exacerbation which are such notable features in the majority of cases. The complaints of pain often seemed to be conditioned by the emotional state of the patient. Optic neuritis was again and again sought for, but in vain, and at the very last the eye-ground presented a practically normal appearance, or at the most one that would be explained by refraction disorder. Cerebral nausea and vomiting were not present, although occasionally the patient suffered from temporary disorders of digestion. Vertigo was so infrequent as to receive little or no attention in making up the diagnostic specification. Local spasms and general convulsions were absent. From the standpoint of general symptoms the case might have been one of hysteria or neurasthenia plus disorder of refraction.

It cannot be doubted that much in the history of the case and many of the symptoms pointed to the diagnosis of grave hysteria. Among these symptoms were unilateral hypesthesia to touch, pain and temperature; persistent contraction of the fields for form and color, irregular color reversals, and frequently recurring states of emotional depression and excitement. When to these were added the fact that the ataxia and paresis vacillated considerably until a late period before the operation, and that optic neuritis and the other general symptoms of brain tumor were absent or subordinate, it will be seen that many reasons existed either for the diagnosis of hysteria or for holding in balance the diagnosis between organic and functional disease. This case affords a striking illustration of

the importance of not making the diagnosis of hysteria until every probability of organic disease has been carefully excluded, and also brings into the foreground the fact so well known to every experienced neurologist that a hysterical syndrome is so often associated with the phenomena of organic lesion. It cannot be too strongly emphasized that a large majority of the cases of brain tumor suffer sooner or later from hysteria. In this case I do not incline to the opinion that the sensory symptoms were hysterical in nature, but rather that they were due to the localization of the lesion, but it is nevertheless true that hysterical stigmata, sensory, motor, visceral and psychical, may be present in any serious organic case.

As is well known, the writer has long maintained that for all practical purposes of diagnosis and of treatment the cerebral areas of cutaneous and muscular sensibility are separate from the motor area, and that the former surround the latter on the lateral and mesal aspects of the hemisphere; in other words, that they are situated in the gyrus fornicatus, quadrate lobule and parietal convolutions. It would be a useless waste of time again to bring up the reasons for and against this view. A few recorded cases besides those of the writer would seem to indicate that not only is this position justified as regards a general area for cutaneous sensibility, but also that in special portions of the sensory area subareas of representation of different portions of the body may be located. The cutaneous hypesthesia in this case persisted until the operation and many weeks subsequently. The thalamus was not directly involved in the lesion, although of course it is possible that it may have been affected by pressure. The tumor was partly cortical and partly subcortical, being chiefly situated in the corona radiata, where it may have involved or compressed the tracts for cutaneous sensation passing between the thalamus and the cortex, but tumors similarly situated in the acknowledged motor area, cortical and subcortical, do not as a rule, or even with any frequency, cause similar persisting sensory symptoms. The most positive and interesting localizing symptoms in the case were disorders of muscular sense with ataxia. This case, with that of Starr and McCosh,¹ furnish striking evidence in favor of the

¹ Am. Jour. Med. Sci., Nov., 1894.

view that the muscular sense is represented in the postero-parietal region. In the case of Starr and McCosh, as will be recalled, a small angioma with some surrounding brain tissue was removed by operation at a point about the junction of the superior and inferior parietal convolutions, clearly caudad of the post-central convolution, with the result of producing complete loss of the muscular sense in the opposite hand and wrist with ataxia, the symptoms disappearing a few weeks after the operation. The results of a surgical lesion in this case were identical with those produced by the tumor of the parietal lobule in the case here reported, the only difference being that in the case of Starr and McCosh the symptoms disappeared, while in my case they were persistent and were added to as the neoplasm increased in size and invaded more and more of the adjacent cerebral substance. True motor paralysis and other evidences of implication of the motor cortex or pyramidal tract were absent until the neoplasm by pressure and invasion had extended beyond the cerebral areas for the muscular sense. It would seem that this case is almost conclusive in its teachings with regard to the separate localization of a region for muscular sensibility.

As the case progressed some atrophy was evident both in the upper and lower extremities, but more marked in the upper, and especially in the forearm and hand. On November 19, when the consultation was held with Drs. Osler and Lloyd, this atrophy was especially studied, and as previously noted the muscles of the hand, forearm, arm, shoulder, breast and leg showed distinct atrophy. At one time it was generally taught in the text-books that when hemiplegia came on after adult life has been reached muscular atrophy of the paralyzed side did not follow, but it is of course now well known that real atrophy, not merely the wasting from disuse, is present in a considerable percentage of hemiplegic cases. Atrophy was present in thirty-five of a series of sixty cases studied in the neurological wards of the Philadelphia Hospital a few years since. While the degree of atrophy in some of these cases was slight, in others it was so marked as to be easily represented in a photograph of the patient. These atrophies are usually attributed to degeneration of the pyramidal tracts and involutions of the

ventral horns, and to degenerations subsequent to peripheral neuritis occurring in the paralyzed limbs; but it is not improbable that in some of the most marked cases the atrophy is related to the destruction of special trophic centers in the cerebrum. Savill² has recorded a case similar in some of its features to the one here reported, a case in which a destructive lesion of the gyrus fornicatus produced persistent vasomotor and trophic changes in addition to a marked but temporary loss of cutaneous sensation. It is worthy of remark that the lesion in the case here recorded extended beneath the cortex very close to the median surface of the hemisphere, and probably involved to a certain extent the subcortical substance in the same position as the lesion in Savill's patient. Before the operation I suggested to Dr. Keen the probability that the tumor had invaded or nearly reached the cortex of the mesal aspect of the hemisphere in the region of the quadrate lobule or the posterior extremity of the gyrus fornicatus, and this was the case as nearly as could be determined by the operation. While the true trophic centers are protuberant and spinal, lesions in certain regions of the cerebrum may induce atrophy by acting from a distance on these centers. These cerebral trophic centers are probably not to be sought for, as has been suggested by some, in the motor region of the cortex, but in the limbic and parietal lobes, which were the chief seats of lesion in the present case and in that of Savill.

As the marked amnesia and paraphasia disappeared in a comparatively short time after the operation, it is probable that they were due to pressure upon the concept areas or upon the tracts which associate the receptive areas for speech with those on the motor side of the brain; or it may be that the amnesia and speech disturbance, like the emotional condition of the patient, were due to the irritating and inhibitory effects of the tumor, and to the general demoralization of the patient.

The concentric limitation of the fields of vision and the presence on one or two occasions of temporary hemianopsia have their explanation in the pressure of the tumor upon the angular gyre and optic radiations.

The normal plantar reflex for at least two months before

² Brain, V., 14, 1891.

the operation could not be promptly and fully elicited on the affected as on the other side, and the Babinski reflex was present towards the last. Doubtless variations in the degree of pressure on the pyramidal tracts accounted for vacillations in the plantar response which became more and more abnormal as the pressure on the pyramidal tract increased, and not improbably just before the operation some fibers of this tract were destructively implicated in the lesion. The same remarks are applicable in explanation of the variations in the knee-jerk and of the presence of ankle-clonus.

SURGICAL REPORT BY DR. KEEN.

Operation Nov. 24, 1899. The location of the tumor, as determined by Dr. Mills and the other neurologists in the case, was deemed to be in the superior parietal lobule, probably subcortical and probably impinging on the median surface, and either directly involving or producing pressure upon the upper part of the post-Rolandic convolution. In thinking over the operation, it occurred to me that it would be a very serious difficulty if I encountered a thick skull, as the flap was not to be in the squamous portion of the temporal, but the parietal, and that it might require a very long time to chisel a large flap in a bone of unknown thickness, and it might even be impossible to fracture the base of the osteoplastic flap. This difficulty I knew had occurred to some of my surgical friends and very seriously complicated the operation. Accordingly, having located the fissure of Rolando, I outlined by my eye the large flap I proposed to make. At one of the two points at the base between which I wished to fracture the flap I made a trephine opening 0.5 cm. in diameter and found that the skull was unusually thick, one centimeter. Had I not first trephined the flap, and so determined its thickness, I should undoubtedly have had great difficulty. A second trephine opening was then made at the other point, and a Gigli wire saw was passed between them. The bone was then sawn about half through without, as was discovered afterwards, producing any injury to the brain. The flap was then outlined by the knife and the bony flap chiseled through. Each of the three sides of the flap measured 10 cm. long. The superior side was parallel

with the median line at a distance of one centimeter. The anterior border was just in front of the fissure of Rolando. No serious difficulty was encountered other than the time consumed on account of the thickness of the skull. This time was diminished also by the freedom with which I chiseled, knowing definitely the thickness of the skull. The dura bulged moderately into the opening. It did not seem more resistant than usual at the upper part, but at the lower portion the dura felt distinctly softer and suggested that there was probably fluid beneath it.

In order to avoid the large veins, and especially their parasinoidal enlargements, the dura was incised with the base of the dural flap above. As I was dividing the dura along the anterior border, the tumor suddenly came into view at the anterior-superior angle of the opening.

When removed, I may add that the tumor measured 5.5 cm. by 4.5 cm., and weighed one ounce and three drams. It was made up of small granular masses about the size of those of an ordinary raspberry, and was of a deep red or purple color. In order to expose the entire tumor a considerable portion of bone was removed by the rongeur forceps anteriorly and superiorly, and the opening in the dura was extended until the entire tumor was in sight. No exact localization could be made by fissures, for by the pressure of the tumor all of these had been obliterated. Evidently the tumor had begun as a subcortical mass and had recently burst through the cortex, for at the margins the cortical substance overlapped the tumor by wedge-like portions of cortex, and gradually thinned as it approached the tumor. By the knife and scissors I then incised and cut the cerebral substance overlapping the tumor, thus separating it from the brain substance. Toward the posterior and inferior border of the tumor I opened a large cyst lying at a depth of 5 mm. below the surface of the cortex. We estimated the amount of fluid which escaped as fully an ounce and a half and possibly two ounces. Some of it was caught in a sterile bottle and was examined for bacteria by Dr. Joseph Walsh. It proved to be sterile. Immediately upon the evacuation of this fluid the patient's general condition improved in every respect. In order to measure the depth of this cavity

and yet not to break through its wall, as I might if I used such a stiff and heavy body as a probe or a pair of hemostatic forceps, I took a thread of silkworm gut, bent it double like a hairpin and passed it into the cyst. When I had inserted it 10 cm. I reached the limit. I introduced my little finger, which is 6.5 cm. long, without reaching the extremity of the sac. This maneuver gave me the additional information that I could get the finger underneath the tumor. The tip of the finger was almost exactly against the falx cerebri. The cavity of the cyst was lined with a whitish membrane covered with soft granulation tissue. Three large veins which led into the tumor were ligated with catgut passed somewhat deeply into the cerebral tissue by a Hagedorn needle, and the tumor was then entirely detached from the cerebral substance. I then found that the walls of the cyst were fairly strong, and with scissors, Horsley's blunt knife and my finger nail I was able to detach the entire cyst from the adjacent cerebral tissue, and gradually to draw it out. No hemorrhage of any amount followed its removal. Packing with iodoform gauze checked the oozing in a few minutes. The opening in the dura was closed with catgut without drainage and it is worth noting perhaps that the cavity left by the tumor and the cyst by this time had filled up so completely that the cerebral tissues were in contact with the closed dura. The flap was then sutured a little iodoform gauze being introduced between the bone and the dura at one point.

Surgically the patient made a complete and very smooth recovery. The day after the operation his temperature rose to 101.4°. By the fourth day it had reached the normal, after which there was no rise of temperature. The stitches were all removed on the sixth day, the wound being entirely well.

Dr. Mills has stated the other facts in reference to his recovery.

On February 23, just three months after the operation, he came to my hospital, got out of a cab unaided, walked up the steps with a just perceptible limp, and when I came into the reception room he jumped up with what might be termed alacrity from his chair, came forward and stretching out his right hand shook hands with me. His speech was entirely

normal, his mental condition excellent. A week later he started on a pleasure trip to the Mediterranean and Egypt.

Remarks.—I must confess that while I was enucleating the sac I was in constant expectation of tearing open the ventricle, but happily, in spite of the great penetration of the tumor, 10 cm. (four inches) by measure, no such accident occurred. In view of his extremely bad physical and mental condition at the time of operation, it is especially gratifying that his recovery at the end of so short a time as three months was so complete. He was practically in every respect his former self, saving a very slight limp, which would scarcely attract attention except from one who was familiar with his history.

PATHOLOGICAL REPORT BY DR. SPILLER.

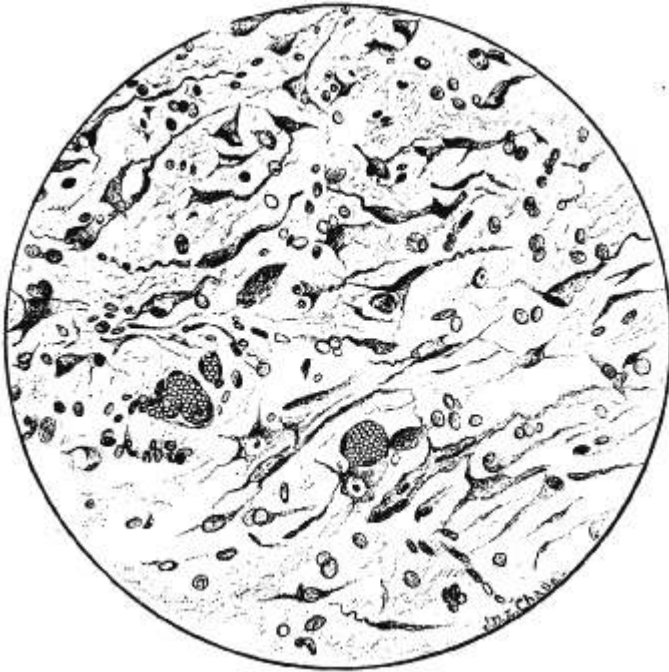
From the Wm. Pepper Clinical Laboratory (Phœbe A. Hearst Foundation).

The tumor was very dark in color, vascular, round and almost globular. A cyst was beneath the tumor, and the wall of this cyst was thick and had therefore been removed at the operation without rupture.

The tumor consists of numerous cells with large round single nuclei staining deeply with Delafield's hematoxylin, and in some places contains small hemorrhages. Blood vessels are very numerous, and about many of these a layer of columnar cells is found. Sections from the interior of the tumor resemble sections from a large round cell sarcoma, but more stroma is present than is found in sarcomas. In portions of the tumor which are of more recent origin the appearance is like that of an endothelioma. Distinct bands of cells containing large round nuclei, occasionally two nuclei, with much intervening tissue are found in these portions, and the bands of cells are not separated by open spaces from the surrounding tissue. A blood vessel is seen in the center of some of these columns of cells, and the cells are arranged about the vessel in such a way that they appear to have originated from it. The tumor is not encapsulated, and is not sharply defined from the surrounding cerebral tissue, and at some places the invasion of the cerebral tissue by columns of tumor cells is distinctly seen.

A portion of the cortex adjoining the tumor was studied

by the thionin stain. Many of the nerve cells near the tumor are greatly atrophied, are deeply stained, and have apical processes twisted like a corkscrew. In some cells the cell body is not thicker than the apical process. All the nerve cells stain diffusely, and chromophilic elements in many of the cells are absent, even in the larger cells where normally they are distinct.



Nerve cells of the cortex near the tumor, greatly atrophied, deeply stained, and having apical processes like a corkscrew.

I would class the tumor as a perithelioma or—as many object to the name of perithelioma—as an endothelioma. The growth probably originated in the walls of the blood vessels, and certainly did not arise in the dura, as the dura was not even adherent to the tumor.